The Diarrhoeal Diseases of Infancy,

Their

Causes, Symptoms, Diagnosis and Treatment

With special reference

To the possibilities of one of these varieties being allied to typhoid fever

And with some new points in their Treatment.

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Introduction. During the last few years, in a district occupied mostly by the working classes, it has been my lot to see many hundreds of cases of infantile diarrhoea, and I think one cannot but be struck by two salient features regarding them, viz. the great number of infant lives sacrificed to the disease, and its continued prevalence every summer, and these, in spite of the many sanitary reforms which have been brought about during recent years. In order to ameliorate these facts, there are in my opinion four points which require special attention. These are:-

I. Increase of our knowledge regarding the causes of these diseases.

II. Prevention of food contamination.

III. More attention to the differential diagnosis of the various forms of infantile diarrhoea.

IV. More attention to treatment, and especially details of treatment.

With regard to the first of these, our knowledge regarding their causes can of necessity only advance slowly; and with regard to the second the purification of our food supplies lies mainly

with the sanitary authorities throughout the country, and though much has been done in recent years, there is still much room for improvement. But with regard to the third and fourth points, much might be done, which it seems to me is often left undone. Are there not hundreds of practices throughout the country, both hospital and private, where every case of infantile diarrhoea is treated with the routine "diarrhoea mixture" and little or no trouble taken to differentiate between the various forms and varieties of the disease? Are not the directions given to the mother as regards the feeding of the child often vague and incomplete, and forgotten by her almost before she has returned home? Are there any precautions taken with regard to the feeding bottles, or the spread of the disease by infection, etc.? It is with special reference to diagnosis and treatment therefore, that this thesis is written: and the arrangement is as follows, in the first part I have given the general causes of diarrhoeal diseases and their relations generally to micro-organisms, leaving any special cause of any variety of the disease to be

dealt with under that variety. In the second part I have given the symptoms, diagnosis and prognosis of the various forms of infantile diarrhoea, together with any special point in their pathology. In the third part I have given a table of differential diagnosis, and the fourth I have devoted entirely to the treatment of the various forms of diarrhoea, instead of referring to each under its particular head when dealing with the symptoms. In this way I have tried especially to draw attention to the diagnosis and treatment.

Classification - An ideal classification which I suppose would be one depending upon pathological findings does not appear to be possible in the case of diarrhoeal diseases, for this reason, that judging from the records of autopsies, the same symptoms may exist with quite a variety of lesions, and that often with quite severe symptoms, the post-mortem lesions are comparatively insignificant: and in the post-mortems which I have made the converse in addition holds good for at least a few of the cases. Accordingly the classification I have used

is based more upon the character of the symptoms and the various causes of the diseases than upon post-mortem findings.

Part I.

General Etiology of Diarrhoea.

Age. Out of 100 cases selected at random by me during about two years, and covering all seasons of the year, in the

first 6 months of life there were	18	
second " " " "	35	
third " " " "	22	100
fourth " " " "	12	
and over two years of age "	13	

In many statistics, the proportion between the number of cases in the first six months and the second six months are more nearly equal than in my figures, but this may be accounted for by the fact that in this district, breast feeding is frequently discontinued after the third month.

Surroundings. Diarrhoeal diseases are more frequent in the city than in the country, and more frequent among the poor than the rich. Their severity

and frequency are increased greatly by lackof cleanliness in apartments, clothing etc., especially by carelessness with the diapers of infants, the infection in this way being spread by the attendant's fingers coming in contact with food, feeding bottles etc.

Dentition. It is quite possible that diarrhoea can be set up by reflex causes, of which dentition may quite easily be one; but the popular connection between the two which takes it for granted that diarrhoea during teething is normal or even beneficial, cannot but be erroneous, for compare the comparative immunity during cold weather from diarrhoea, with the mortality from it in the summer, yet dentition proceeds in each case alike.

Constitution. Everything which lowers the vitality, especially anaemia, syphilis, tuberculosis and rickets.

Diet. Of 1,000 fatal cases investigated by Dr. Hope of Liverpool only 30 had the breast exclusively: of 341 cases investigated by Ballard only 7 had the breast. The chemical composition of cow's milk cannot be the cause, for the milk in the winter

and in the country is safe, whilst in the summer and in the city the reverse holds good. It must be then. the manner of handfeeding which helps milk to play its important role in diarrhoeal diseases; unsuitable bottles, irregular feeding, the injudicious addition of starchy foods, overfeeding, and many other similar causes, all unite in setting up chronic infantile dyspepsia, and the stomach and intestines then form a fertile soil for the growth and multiplication of any micro-organisms that may be introduced therein.

Contagion. I have come to the conclusion that attention altogether inadequate is paid to contagion as a cause of diarrhoeal diseases. Of the 100 cases before mentioned by me, in 87 there were other cases of diarrhoea in the house, or the attendants or the child had come into contact with cases of diarrhoea: to take an illustration of my meaning, among the working classes it is customary for the neighbours to be in and out of each other's houses all day long, this is especially the case if there is illness in the house, the neighbour (who generally has a child of her own) takes charge of the sick baby

while the mother goes out, and changes its diapers etc.; she then goes back to her own house to get the milk ready for her own child, and in 24 - 48 hours her child becomes infected.

May not infection spread in this kind of way account for children at the breast becoming infected, where one can practically exclude direct bacterial infection from the food? In my opinion it does. Are not many epidemics obviously infectious, judging by the spread of the disease in certain areas exposed to the infection? And is it not reasonable to presume that infection may be spread in the same manner as in Typhoid fever, viz. by particles from the stools being dried, and then blown about? And if this is so and the disease is spread by these means, ought we not to treat the cases like those of infectious diseases, viz. by isolation of the patient, disinfection of the stools as in typhoid etc.? I believe if some such plan as this was insisted upon by the sanitary authorities of our large towns, the number of cases would be reduced by at least one half.

Temperature. The relation of diarrhoeal diseases to

atmospheric heat is peculiar. From the records of many observers it appears to be this, that for the disease to become epidemic a temperature but a little below 60° is necessary, and a rise of a few degrees more leads to an enormous increase in the death rate (Seilert). All observers seem to agree that a succession of warm days is necessary before the amount of diarrhoea becomes increased.

Is heat a direct cause of diarrhoea? In the light of our present knowledge, which undoubtedly points to micro-organisms being the direct cause of diarrhoeal disease, this view appears to be altogether inadmissible; atmospheric heat is however an important predisposing cause of the disease, because when the temperature is at or about 60° then all the factors necessary for the propagation of the disease are present, and are at their best. It also acts by causing depression of the nervous system in young infants, and in this way interferes with digestion: also by increasing thirst and the amount of perspiration, and thus leads to the taking of more food.

Nursing children. Amongst these, anaemia, pregnancy, grief, menstruation and chronic dyspepsia seem to predispose to attacks of diarrhoeal diseases.

Relation of Diarrhoeal Diseases to Bacteria.

No bacillus has so far been isolated that can be shown to be a constant cause of diarrhoeal disease, and at present the general opinion seems to be that many organisms may possess the power, if given favourable opportunities, e.g. Bac. Coli Communis, streptococcus, proteus vulgaris have all been thought to be the probable cause. Booker has isolated 40 different kinds of Bacteria in the stools of diarrhoeal diseases. The typhoid bacillus is in my opinion responsible for one form of the disease. at least, and my reasons for thinking so I refer to later. With our present knowledge then, the grounds for Bacterial infection in diarrhoeal diseases is deducible, partly from pathological findings, but mostly I think from analogy to other well defined bacterial infections, and from the clinical course and etiology of the diseases.

Taking these reasons for Bacterial infection then in the order named above -

(a) Pathological Findings - The isolation of the numerous micro-organisms mentioned above, by Booker and others, from the stools and intestines of infants who have died of Diarrhoeal disease.

(b) Analogy to other infections, and (c) Clinical course. We find high temperatures (which are not inflammatory as shown by post-mortem examinations) albuminuria without organic kidney disease, depression of the heart's action, profound nervous symptoms, such as coma or convulsions (without any demonstrable brain lesion); all these must surely indicate the presence of micro-organisms in the system, causing not only local effects such as diarrhoea and vomiting, but also the general effects on the body just mentioned, indicating the development of toxines and their absorption into the blood.

(d) Etiology - The diseases are most frequent under conditions that favour bacterial growth, such as in crowded cities, amongst dirty people, where unclean utensils are used, and where the atmospheric temperature is high. They are prevalent where cow's milk

is used which is a good culture medium for Bacteria, and one in which they can often be found especially when it is kept for many hours in summer weather. Therefore although no specific organism has yet been isolated as a cause of diarrhoeal diseases, I think there is ample evidence for showing that undoubtedly they are directly dependent on Bacterial invasion. If then, Bacteria are the direct cause of the disease, how is it that the predisposing causes of the disease, such as diet, are looked upon as such important factors? The answer is that the predisposing causes act mainly in two ways, either (1) by increasing the invulnerability of the body to Bacteria, or (2) by assisting in the development and multiplication of Bacteria outside the body, or by both. For example, taking the most important predisposing cause, that of feeding; if the food given be improper in quality or if too much food is given, or if there is failure of digestion for any reason, the result is that there remains in the intestine a quantity of unabsorbed residue; this undergoes putrefaction forming a splendid soil for Bacterial development: the vulnerability of the body is thus

greatly increased. The food too is often the culture ground of Bacteria before it enters the body, and therefore assists in the development and propagation of Bacteria. Atmospheric temperature is also important, because it increases the vulnerability of the body by causing nervous depression, and an increase of tissue waste, and is also suited to the development and spread of Bacteria. Tender age and dentition act by increasing the vulnerability of the body: nervous influences, like menstruation in nursing mothers acts in the same way; and the insanitary surroundings of the child by aiding the development and spread of Bacteria.

Note. In the Brit. Med. Journal, Feb. 21st, 1903.

Prof. Delépine of Manchester, in a paper on epidemic diarrhoea, says that he concludes from an examination of all the circumstances, that the infectious properties which food acquires frequently in summer, and which gives rise to the ordinary summer type of epidemic diarrhoea are generally due to the Bacilli of the colon group, of which the B. coli communis (Escherich) and the B. enteriditis (Gaertner) were probably the two extreme types.

Thus the direct causes (viz. micro-organisms) and the indirect (viz. conditions of feeding, temperature, etc.) are very closely connected in the case of diarrhoeal diseases.

Part II.

Symptoms, Diagnosis, and Prognosis of the various forms of Diarrhoeal diseases, with any special points in their etiology and pathology.

(A) Simple Diarrhoea without Bacterial infection.

Special causes - Foreign bodies, or anything which may act as such, e.g. fruit stones, nuts, lumps of meat, pieces of suet, partly cooked rice or barley etc. Diarrhoeas produced by causes acting on the nervous system come under this heading, e.g. dentition, exposure to extremes of heat or cold, menstruation or grief or fright acting through a nursing mother.

Pathology - There is a certain amount of hyperaemia in the small intestine, along with increased secretion chiefly serous in nature, and also increased peristaltic action of the bowel. There are no in-

flammatory changes dependent upon decomposition of intestinal contents. The peristalsis and hyperaemia are either from local irritation or of reflex origin.

Symptoms. The negative symptoms are the most important: there is no vomiting, and no temperature, and the tendency is to spontaneous recovery especially when dependent upon an irritant; these negative symptoms exclude the more serious forms of diarrhoea. There is little or no pain, and where present is usually for a few moments before each motion and is griping in character. The stools are first soft and then thin and watery; their colour is generally pale yellow, in older children brown, or dirty grey; their odour is unpleasant, and considerable.

Diagnosis. Exclude the Bacterial varieties of diarrhoea, by (I) the history - generally of some temporary error in diet, such as eating fruit, by (II) the thermometer showing the absence of fever, by (III) the absence of vomiting, by (IV) the tendency to recovery where the contents of the bowel have been thoroughly evacuated.

Prognosis. Recovery generally takes place rapidly and completely.

B. Diarrhoeas of Bacterial Origin.

The diseases under this heading may be classified as follows:-

(a) Acute gastro-intestinal Catarrh

(b) Cholera Infantum.

Acute Gastro-Intestinal Catarrh -

Let me say here that, as I understand it, both this affection and that known as"Cholera Infantum" are included in the terms "epidemic diarrhoea" or"epidemic enteritis" as recommended by the Royal College of Physicians (Eng.), in their suggestions as to certifying deaths from diarrhoea.

Pathology. A diarrhoea originating from undigested food in the bowel and putrefactive changes in such food due to the presence of organisms. If the disease continues for long, anatomical changes are produced, but at first it is only a functional disorder.

Symptoms. Begins with diarrhoea as a rule severe, there is restlessness, temperature runs up to 102° - 104°: may be convulsions at the onset; great thirst. After a few hours gastric symptoms

are added to these, frequent vomiting first of curdled milk or undigested food and afterwards of mucous serum or bile. The diarrhoea then becomes more severe, often hourly, the stools are thin and yellowish, or greenish yellow and are accompanied by a great deal of flatus; this latter point is important to note: there is a considerable amount of pain before each discharge, shown by the crying and restlessness of the child, which is temporarily relieved by the motion.

Besides this severe form there is a milder form in which all the symptoms are less severe. There is diarrhoea for some days, and the child is fretful and peevish, accompanied by a little rise in temperature, generally about 99°. The tongue is coated and the appetite impaired. The stools are green or yellow containing undigested milk curds, and sometimes mucus : vomiting often absent.

Diagnosis. The severer form is often confused with Cholera Infantum which resembles it in its sudden onset, but in cholera infantum, the prostration is much greater, the temperature is much higher,

and most important of all cholera infantum is distinguished by stools which are large in quantity, watery or serous in consistence, neutral or alkaline in reaction, and with very little smell: in acute intestinal catarrh the stools are not large, they are green or yellowish green, the odour is bad, and they are accompanied by a great deal of flatus.

The milder form of gastro-intestinal catarrh is liable to be ignored by mothers, and put down to teething, and a more serious disease may thus be begun, i.e. entero-colitis.

Prognosis. Although the prostration is great in the severe form, it is of short duration, and if treatment is satisfactorily carried out, and the child's constitution good, convalescence will set in on the 2nd or 3rd day. If however the disease attacks weakly marasmic children, or those suffering from rickets or syphilis, or with chronic dyspepsia, or tuberculosis, and such children are very liable to be attacked, then the tendency is for the disease to terminate in either entero-colitis or death.

If entero-colitis, then the temperature remains raised, and symptoms of inflammatory changes in the bowel

are set up. If the disease is tending to terminate in death, then as a rule the vomiting and purging cease, but the face becomes sunken, the fontanelle depressed, the pulse feeble or absent, the skin cold and clammy, and convulsions or coma usually close the scene.

(b) Cholera Infantum.

This is, comparatively speaking, a rare form of diarrhoea, and should not be confused with severe cases of acute gastro-intestinal catarrh.

Etiology - Most cases are preceded by a mild gastro-intestinal catarrh. All the predisposing causes of diarrhoea apply to cholera infantum, especially as regards feeding; probably it never occurs in breast fed children.

With regard to frequency, out of the 100 cases I before mentioned, only two could I think be correctly ascribed to cholera infantum.

Symptoms. The suddenness and severity of the symptoms indicate the presence of some powerful toxic substance in the blood, derived from Bacteria in the alimentary canal. As a rule the first symptom is a convulsion, or else the child is seized with a

fit of screaming altogether uncontrollable: this is accompanied by a rise of temperature to 104° or 105° or even higher: the pulse is generally too rapid to be counted with accuracy, but is always over 140 per min.

The vomiting and diarrhoea quickly follow the nervous symptoms and the rise in temperature.

Vomiting is incessant, anything given by the mouth is rejected immediately: first food is vomited, then mucus, and finally bile.

The stools are very large, they are watery, alkaline in reaction, and have very little odour: the amount of fluid indicates a paralysis of vaso-motor nerves, and this results in a great transudation of serum, which causes the large watery stools.

The loss of this large amount of fluid causes great thirst; and great prostration: the abdomen is retracted and compressible. The great prostration is shown by the sunken face, the anxious expression, the depressed fontanelle, and the almost imperceptible pulse.

In cases going on to a fatal termination the vomiting and purging may cease but the hyper-

pyrexia continues, the pulse is absent, the breathing irregular or of the "Cheyne-Stokes" variety, the skin cold, the tongue dry and brownish black in colour, and convulsions, or more commonly coma, close the scene.

The cases are very rapid in their course and as a rule terminate in 24-48 hours.

The whole course and symptoms of the disease clearly indicate its Bacterial origin and are due to the absorption of toxines developed by bacteria. In evidence of this, we find (I) no cerebral or renal changes to account for the nervous symptoms (II) no inflammatory lesions in the stomach or intestines to account for the severe vomiting and diarrhoea, (III) the toxic symptoms of high temperature and prostration, (IV) The paralysis of vaso-motor nerves and consequent transudation of fluid which causes the excessive thirst and rapid wasting.

Diagnosis. Cholera infantum is in reality a comparatively rare disease: but it is often confused with the severer form of acute gastro-intestinal catarrh: in the latter, however, the temperature is not so high, the nervous symptoms are

all very much less and the vomiting and purging are also much less: the appearance of the stools is however the most trustworthy guide: in acute gastro-intestinal catarrh the stools contain undigested food, are green or yellowish green in colour, are very foul, and accompanied by much gas. In cholera infantum, the stools are purely serous, with little or no solid substance: there is no smell or very little: they are alkaline: and are unaccompanied by gas.

Prognosis - If the term cholera infantum is used in its right sense, the disease proves to be a very fatal one, and the cases seem to be very little influenced by treatment of any description. The mortality is rendered higher I think because the disease generally attacks weakly children, suffering from rickets, syphilis etc.; or else supervenes on a mild attack of gastro-intestinal catarrh. I have occasionally seen cases of entero-colitis, which from the history have apparently begun as cases of cholera infantum, then partially recovered, and then gradually passed into cases of entero-colitis.

(c) Entero-colitis, or forms of diarrhoea in which

an inflammatory lesion of the intestine can be demonstrated, but not including chronic diarrhoea. Many other names are used for this variety of diarrhoea, e.g. follicular enteritis, dysenteric colitis, enteritis etc.: these terms I think are not suitable because they suggest a localization of the disease to a particular portion of the bowel.

These forms of diarrhoea which have a demonstrable inflammatory lesion, and which are included in the general term of Entero-Colitis, I have divided into four varieties.

(a) Dysenteric form.

(b) Secondary form - called so because it is secondary to acute-intestinal catarrh or cholera infantum.

(c) Typhoid form - called so because I have thought it probable, for reasons which I will state, that the originating cause is the typhoid bacillus.

(d) Subacute form.

These varieties are of more interest (from an etiological and pathological point of view) than clinical importance: for although the symptoms of each form vary somewhat, yet, as the treatment of

the four varieties is much the same, the diagnosis of the one from the other is not of cardinal importance.

Dysenteric form.

Symptoms - Generally the onset is gradual, beginning with looseness of the bowels, loss of flesh, and impaired appetite. The important diagnostic symptom is the character of the motions: they are frequent, small, consist mainly of mucus, or mucus mixed with blood, and are preceded and accompanied by severe tenesmus: all these points about the motions are important to note, and are fairly constant and characteristic of dysenteric entero-colitis.

(b) Secondary Form.

Entero-colitis may be secondary to measles, scarlet fever or diphtheria; this is however rare. Generally it is secondary to acute gastro-intestinal catarrh: this is especially likely if there have been two or three attacks of that disease: or gastro-intestinal catarrh may gradually merge into entero-colitis, the acute nervous symptoms and the vomiting becoming less, but the intestinal symptoms continuing. The acute symptoms of cholera infantum may also

gradually merge into those of entero-colitis, this however is rare also.

Symptoms. Temperature is an important symptom and one which is often overlooked. Many practitioners who most punctiliously take the temperatures of their adult patients, somehow or other, never dream of doing so in the case of a child with diarrhoea. If there are intestinal symptoms with a continuous temperature, it is reasonable to assume inflammatory changes in the bowel: when temperature is due to toxic changes it is of short duration, as in acute gastro-intestinal catarrh. The temperature there is continuous, but not otherwise typical; it is liable to sudden rises which are probably toxic in origin.

Pulse. In bad cases is intermittent or irregular: is not in any way typical.

Character of the stools - May be small and frequent, or larger and less frequent. They consist of undigested food, milk curds if milk is given, or portions of partially digested cereals mixed with mucus if these are given: epithelial cells, bile and pus are sometimes seen. Their appearance is that

of chopped up boiled cabbage, often streaked with blood: the smell is abominable. Pure mucus stools are rare. The blood depends on congestion and not on ulceration of the bowel.

Abdomen. Is compressible, and soft.

Nutrition. Emaciation sometimes is so marked that one marvels how the infant keeps alive - yet these children often slowly improve under appropriate treatment.

Vomiting. As a rule there is little or no vomiting, except at intervals during the course of the disease, when it is probably due to an intermittent attack of gastritis.

Nervous symptoms. After the disease has been in progress some time the nervous symptoms are those of exhaustion, dullness and apathy, the infant lying with dull listless eyes, taking no notice of any of its surroundings.

Mouth. The tongue is dry, red and has a glazed appearance: the various forms of stomatitis are common.

Urine. Albumen is sometimes found in the urine in small quantities.

The symptoms relating to temperature, pulse, vomiting, nutrition etc. which I have described here, are equally applicable to the Dysenteric and subacute forms of Entero-Colitis; but I have described them more at length under the head of the secondary form of entero-colitis, as I believe that this is the more common form of the disease.

(c) Typhoid form.

During the hot summer and autumn of 1901, I was struck by certain cases of infantile diarrhoea, which had none of the symptoms due to a more or less sudden invasion of Bacteria, and absorption of toxins produced by them, such as one sees in what is generally termed epidemic diarrhoea and which I have described under the name of "gastro-intestinal catarrh" and "Cholera Infantum". They certainly were not cases of simple diarrhoea, and they differed in many ways from the other forms of entero-colitis which I have mentioned, and neither their duration or clinical course would place them under the heading of chronic diarrhoea. These cases occurred generally in previously healthy infants, they had not been preceded by any other form of diarrhoeal

disease and therefore were not secondary forms of entero-colitis; the temperature was marked by morning remissions and evening rises, with often a difference of two or three degrees between 8 a.m. and 8 p.m.: there was little or no vomiting, and sometimes the diarrhoea was accompanied by considerable haemorrhage from the bowel: it occurred to me therefore that perhaps these cases were due to Eberths bacillus of typhoid fever. However, it is an easy matter to consider the possibility of two diseases being identical from a review of their symptoms, but a much more difficult matter to scientifically prove that such is the case: this latter I do not claim to have done by any means, but what I do hope to show is, that it is possible at any rate that certain cases of infantile diarrhoea are produced by infection with the typhoid bacillus either alone, or in conjunction with other micro-organisms.

My difficulty in investigating this matter has been lack of post-mortem opportunities: in the first place, the cases which have come under my notice were by no means as numerous as the other forms of diarrhoea; in the second place the number of deaths were few; and in the third, anyone who is

in private practice knows how difficult it is to obtain the consent of relations for a P.M. examination. Accordingly I decided to test the theory by means of Widal's well known reaction of the serum of typhoid patients on the typhoid bacilli: the results of this experiment I give below.

The cases on which I carried out this investigation were 20 in number: they were all under two years of age, and over six months; they had been fed on foods other than breast milk: and they all had symptoms corresponding more or less exactly with those which I have described and to which I refer later. The test was not applied before the second week of illness in any of the cases: the blood was taken from the lobe of the ear in each case.

Of the twenty selected cases, during the second week of illness eleven gave a typical reaction within an hour, the movements of the bacilli having wholly ceased, and they were aggregated into clumps: Seven gave the reaction but did not react under two hours, and two were over four hours: the aggregation of clumps was not so marked in these seven cases, though in all of them it appeared more or less.

Two gave no reaction during the second week.

During the third week of the illness, of the eleven that gave a marked reaction in the second week, only five gave a marked reaction, four gave a reaction after two hours: and two gave no reaction. Of the 7 that gave a less marked reaction during the second week 3 gave a better reaction, the movements of the bacilli more quickly ceasing, and the aggregation of the bacilli more marked: in 2 the reaction was as during the second week; and the remaining two gave more after 12 hours trial. Of the 2 that gave no reaction during the second week of the illness, one still gave no reaction, but in the other one the reaction was well marked.

During the fourth week of the illness only 6 of the 20 cases gave the reaction at all: of these 6, two were cases which had given a marked reaction during the second week of the illness, three were cases that had given a less marked reaction during the second week, and one was the case that had given no reaction in the second week, but had done so in the third week.

During the fifth week one case, out of the

20, gave the reaction and it was the same case mentioned in the last paragraph.

During the sixth and following weeks up to the tenth none of the 20 cases gave a reaction.

The cases which gave a marked reaction during the second week, and a less marked reaction during the third week or no reaction, were those in which the symptoms were greatly ameliorated, or in which the disease had apparently been abated. On the other hand, the cases which gave a less marked or, as in one instance, no reaction during the second week, and gave a well marked reaction in the third week, were those in which the symptoms became more marked, that is to say the diarrhoea became worse, or the nervous symptoms of stupor and listlessness more marked, or as in three instances, there was haemorrhage from the bowels.

Two out of these twenty cases died - one from broncho-pneumonia some weeks after recovery from the diarrhoea: and in the other, although I made a post mortem examination, and there was certainly swelling and enlargement of Peyers patches and the solitary glands, and three or four fairly large

ulcers in the bowel, yet I was unable to obtain a culture of the Typhoid bacillus - but one is not justified in forming any conclusions from an isolated case.

The conclusions or rather probabilities which I deducted from these investigations were as follows.

I. That certain cases of so-called entero-colitis are due to Eberth's bacillus, either alone or in addition to other organisms.

II. That the infection is generally of a less intense variety than is seen in ordinary cases of typhoid fever.

III. That the disease tends to be eliminated from the system much more quickly than in the case of typhoid fever.

IV. That consequently if the disease is due to Eberth's bacillus, it is probably an attenuated variety of that bacillus, and not one of sufficient virulence to cause an attack of typhoid fever in an adult, where tissues have a greater resistive power.

V. That the blood serum much more readily loses its power of interfering with the behaviour of the typhoid bacillus, than it does in ordinary cases of

typhoid fever.

VI. That the power of the serum, in interfering with the behaviour of the typhoid bacillus, can be taken as a criterion of the virulence of the disease; i.e. with a slight Widal reaction, there is correspondingly slight form of the disease and vice versa.

VII. That if the disease is not due to Eberth's bacillus, then it must be due to some organism which causes the blood serum to have a similar power over the movements of typhoid bacilli, as is seen in true cases of typhoid fever.

Symptoms. Those to which I wish to call special attention are:-

Temperature - which shows morning remissions and evening rises - but does not show the step-like gradual ascent seen in the early stages of typhoid.

Onset of the disease - which is insidious, generally marked by restlessness, loss of appetite and looseness of the bowels.

Nervous symptoms. In the third or fourth week are those of stupor and languor, seldom convulsions.

Abdomen - which is distended with wind in the early

stages; but there are never any rose-spots or other eruption: haemorrhagefrom the bowel is by no means infrequent in these cases and is often considerable in amount.

Prognosis. - Death is rare except from complications such as broncho-pneumonia.

Note. In carrying out my investigations with Widal's reaction the method I used was that described by Dr Delepine of Manchester, in the British Medical Journal, during April 1897: As a control test, I tested the serum of 15 cases of the ordinary "epidemic diarrhoea" 12 of whichwere cases of gastro intestinal catarrh, and 3 cases of cholera infantum (i.e. taking the classification I have used in this paper): the serum of these cases interfered in no way with the behaviour of the typhoid bacilli after 12 hours' trial: with the exception of one case of apparently gastro-intestinal catarrh which came under my notice after two weeks' illness, and which without stopping the movements of the bacilli, seemed to diminish them and to produce a tendency to clumping amongst them.

Sub-acute form of Entro-Colitis.

This form is in reality a continuation of the

other forms of entero-colitis, usually of the dysenteric and secondary forms, but seldom, if ever, of what I have described as the typhoid form.

Symptoms - The fever, nervous symptoms and vomiting abate, but there continues to be occasional attacks of diarrhoea, and the stools improve for a few days and then get worse again and contain quantities of mucus and undigested food. In addition to these symptoms there is much emaciation and anaemia. If these symptoms are combined with a temperature varying between 99° and 102° and continuous for 3 or 4 weeks, ulceration of the intestine is highly probable.

Prognosis. If recovery takes place it only does so very slowly and after prolonged convalescence: often although recovery occurs the constitution is left much impaired. Broncho-pneumonia is much to be dreaded as a complication in these cases. These cases often degenerate into cases of chronic diarrhoea.

(D) Chronic Diarrhoea.

Not including that due to tuberculosis. or membranous enteritis or mucus disease.

Etiology. - The cases may be secondary or primary. Secondary cases are preceeded by acute-

intestinal catarrh, or entero-colitis and sometimes by measles, scarlet fever or diphtheria. Primary cases may be caused by constitutional diseases, syphilis tuberculosis of lungs, ricketts, chronic broncho-pneumonia. Often caused by prolonged lactation especially if the mother delicate: but is much more commonly due to errors in diet of artificially fed children. It is a form of diarrhoea which often occurs after 18 months of age and under 3 years.

Pathology - The lesions may on the one hand be those of catarrhal or follicular inflammation, or on the other may be ulceration of the intestines.

Symptoms - As a rule children with chronic diarrhoea are brought to the doctor not for the diarrhoea, but for the wasting and inability to take food. In general appearance they are puny, and wasted sometimes almost to a skeleton, they are pale and listless and the fontanelle is depressed.

Tongue - is dry and red, papillae atrophied stomatitis in its various forms is common, vomiting is generally absent: the skin is loose wrinkled and dry, sometimes petechiae are noticed: pulse is weak and rapid, and the extremities are cold from the poorness of the capillary circulation: the temperature is

normal but more often sub-normal. Nervous symptoms are those of apathy and dullness, though the infants are often very irritable when nursed: the abdomen is retracted and sunken.

Stools. - not very frequent, about 4 on the average per day: they are semi-solid and very foul if milk is given contain masses of fat and casein: if solid food is given it is passed undigested along with mucus. Bagensky says if stools are normal in consistence, the colour of meconium, and foul, it indicates a wide spread inflammation of the mucous membrane of the intestine, with atrophy of Lieberkuhn's Follicles. Pus can be seen in the stools with the microscope. There is generally tenesmus, flatulence and pain on passing a motion.

Diagnosis - In chronic diarrhoea this is important, and the prognosis is very much dependent thereon: the cases due to syphillis, tuberculosis, rickets, etc. must be distinguished from those due to improper feeding. When chronic diarrhoea follows other disorders such as gastro-intestinal catarrh or entero-colitis those cases in which the febrile symptoms continued for long will probably have ended in ulceration of the intestine and will not get better,

while others in which there is no ulceration, although just as cachectic in appearance etc. will gradually improve.

Tuberculosis is often difficult to distinguish from chronic diarrhoea. In chronic diarrhoea the temperature is normal or subnormal, in Tuberculosis fever is rarely absent. In chronic diarrhoea the previous health more likely to be good than in tuberculosis. The abdomen is distended in tuberculosis; in chronic diarrhoea it is retracted. The wasting in chronic diarrhoea is proportionate to the amount of diarrhoea: in tuberculosis the wasting progresses whether the diarrhoea is increased or not.

In chronic diarrhoea consolidation of the lung is generally at the base and is due to chronic broncho-pneumonia: in tuberculosis the consolidation is generally at or towards the apex, and is due to tubercular deposits.

Tubercular meningitis is much more common in tuberculosis of the bowels than in chronic diarrhoea.

Glands in the abdomen can often be felt in tuberculosis; but not so in chronic diarrhoea.

The diagnosis cannot be made from any one or

two symptoms; all the facts must be considered.

Part III.

Table of Diagnosis of the various forms of infantile diarrhoea - which have been described in parts I and II (except Chronic Diarrhoea)

		Diarrhoea due to Bacterial Infection.		
	Diarrhoea without Bacterial infection or simple diarrhoea.	Gastro-Intestinal Catarrh.	Cholera Infantum	Entero-Colitis.
Character of onset	Generally due to indiscretion in diet: onset sudden.	Due to undigested food in bowel and action on it of Bacteria: onset gradual.	Course of disease indicates severe Bacterial invasion: onset sudden.	The typhoid form begins insidiously: The secondary form follows generally gastro-intestinal catarrh.
Temp.	None	102° - 104°	104° or higher	99° - 101° In typhoid form the temperature is remittent.
Vomiting	None	Frequent curdled milk. mucous serum, bile.	Incessant and without relation to food.	None except at intervals.

Diarrhoea due to Bacterial Infection. Cont^{d}

	Diarrhoea without Bacterial infection or simple diarrhoea.	Gastro-Intestinal Catarrh.	Cholera Infantum	Entero-Colitis.
Stools.	Soft and watery, pale yellow.	Greenish yellow, frequent, accompanied with flatus, odour bad.	Large, very watery alkaline, no flatus, odour none.	In dysenteric form, much mucus, streaked with blood. In secondary forms undigested food. In typhoid form often much haemorrhage.
Abdomen.	Normal	Distended	Generally not distended.	Compressible and soft: in typhoid form distended.
Pain.	Very little	A little	None	
Exhaustion	None	Considerable	Very great	Considerable
Nervous symptoms.	None	Convulsions not common Coma uncommon	Convulsions usually at onset: later Coma.	Apathy and listlessness.
Duration.	A few days	About 4 - 5 days if conditions favourable.	About 48 hours	From 2 or 3 weeks to several months.
Probable course.	Recovery	Probably recovery.	Probably death.	Often recovery: if death it is generally by intercurrent disease.

In the foregoing table I have not included chronic diarrhoea: and as the only disease liable to be confused with it is tuberculosis of the intestine, I have entered into the differential diagnosis pretty fully when dealing with chronic diarrhoea.

N.B. In the table of diagnosis I have not mentioned the "Widal test" for the typhoid form of entero-colitis this of course can be applied, if my conclusions are right.

Part IV.

Treatment of the Diarrhoeal diseases, dealt with in parts I, II and III.

In dealing with the treatment of these diseases I have made no attempt to deal with all the various methods of treatment or with the exhaustive list of remedies which have been recommended by various authorities, but only with those methods and drugs which I have personally used, and with the results of which I am conversant by experience.

To save repetition I will deal in the first place with some points which are applicable to all the diarrhoeal diseases which I have described.

Prophylaxis. - In this age of preventive medicine, the suppression of the causes of disease is becoming more important every year: and of no diseases can this be so truly stated than in the case of the diarrhoeal diseases of infancy.

(1) Prophylaxis as regards milk supplies.

I think this can reasonably be divided into two sections: firstly - precautions to be taken before the milk reaches the consumer: secondly - precautions to be taken after the milk has reached the consumer.

Precautions before the milk reaches the consumer. - As evidence of the enormous necessity of this, I will give some quotations from the British Med. Journal of March 21st 1903, in an article on the milk supply of large towns: according to Klein in the above article "milk received and brought in a sterile vessel from a shop and kept at 37°C may the next day or the day following be completely clotted and sour due to the growth of the bacillus coli or be decomposed by proteus vulgaris or bacillus mesentericus or it may be full of gas, clotted with a large amount of clear whey caused by the growth of the anacrobic bacillus enteriditis sporogenes": Also

from the same article in a table shewing the number of Bacteria in 17 drops of milk, under various conditions of milking and handling: at or shortly after milking: (A) with scrupulous cleanliness 4.333: (B) Cleanliness 14,550: (C) Cows dirty, in winter 16,650, in summer 30,366. After 24 and 48 hours these numbers of bacteria enormously increased. Facts such as these prove beyond dispute the necessity for precautions in milk supply, it is only possible for me here however to indicate the main lines along which our energies should be directed.

(1) Care in the selection of the site of farms where the cows are to be kept.

(2) Selection of healthy animals, each one to be examined by a skilled vet periodically: milk of cows immediately after calving not to be used.

(3) Care of cow sheds - cleaning, lighting, ventilation, water supply etc.

(4) Care of the cow - Careful feeding: careful grooming every day: and especially cleansing of the udders before milking.

(5) Cleanliness of the hands and person of the milker.

(6) Isolation of any case of infectious disease amongst the attendants of the cows and their families.

(7) Cleanliness, if possible sterilization of all vessels used in the milking.

(8) Exclusion of strangers from the milking premises.

(9) Exclusion of other animals from the cow sheds - such as dogs, cats, fowl etc.

(10) Care in the transport of the milk by careful closing of the vessels and keeping them cool while awaiting transport.

(11) Quick transport in cool well ventilated trucks.

(12) Samples of each day's milk to be examined by experts in the laboratory.

(13) Delivery of the milk as soon as possible after its arrival at its destination to the consumer.

In order to attain to these conditions, the milk supply of towns should be received from farms specially conducted for the purpose by persons of experience and reliability. As long as milk is received from the ordinary farmer these precautions will not, I am convinced, be ever carried out, unless the farmers supplying the milk would consent to rigidly execute the precautions I have mentioned, and their processes be constantly subjected to skilled supervision.

Precautions <u>after</u> the milk has reached the consumer:

these may be summarised as follows.

(1) It should be used as soon as possible after its arrival.

(2) It is to be kept in an absolutely clean vessel.

(3) It is to be kept cool - never in the sun or in a hot place.

(4) It should be protected from contamination by flies - this is most important, an ordinary meat safe answers very well.

(5) The most scrupulous cleanliness to be observed with regard to feeding bottles and teats: at least two bottles should be in use. The bottle after use to be scalded out with boiling water and again before using, and in the interval of feeding to be kept in water which has been boiled and to which a pinch of bicarbonate of soda has been added.

(6) Failing a guarantee of pure milk such as can only be obtained by precautions which I have mentioned - and in how many towns at the present time can such milk be secured? - I feel convinced by practical experience and observation that the milk ought to be boiled. It is said and I fully agree with the statements that by doing so the milk

loses much of its nutritive value: the emulsion of cream is broken up: the sugar is converted into caramel: carbon dioxide is given off: and many important organic compounds may be broken up. All this may be quite true, but I am certain that even this is far preferable than running the risk or often rather having the certainty of introducing virulent pathogenic organisms into the infants stomach, which are admittedly destroyed by boiling.

The milk should be boiled as it is required for use and allowed to cool, on ice if possible.

N.B. In some towns of late years the preparation and distribution to poor persons of Humanized milk has been followed with much success, and in Liverpool I had an opportunity of noting the method and its results. The method briefly is this - Milk from as pure a source as possible is obtained and put through a separator in order to obtain the cream and better part of the milk. The amount of proteid is estimated and boiled water is then added to bring the milk to the human standard: sugar and if necessary cream are then added, and the milk is then bottled and hermetically sealed. The

bottles are then placed in a steam sterilizer for 30 minutes at a temperature of 150° (Pasteurising): the bottles are then cooled and kept in a refrigerator until they are required for use, but are never kept longer than 24 hours.

No one can doubt the superior value of such milk over boiled milk; but at the same time humanized milk depots are unfortunately as yet few and far between, and until either it can be obtained or fresh milk from such dairies as I have indicated, it certainly ought to be boiled.

Prophylaxis as regards infection - I have stated when dealing with the causes of these diseases that I thought far too little attention had been paid to infection as a cause of diarrhoeal diseases. Personally I am as certain of the infectiousness of certain forms of diarrhoea amongst infants as I am of the infectious nature of scarlet fever. One can trace dozens of such cases in every epidemic; this more particularly applies to the forms I have classified as "gastro-intestinal" and "cholera infantum" and to the typhoid form of enterocolitis. The method of infection is by means of the stools of the infected infant, infecting the food

of another infant. I gave a common illustration of this under the "causes" of diarrhoeal diseases. Every precaution is taken by the sanitary authorities to prevent the spread of Scarlet fever, diphtheria etc., why should not the same precautions be taken with regard to "'Epidemic' diarrhoea"? If all cases of diarrhoea were not so treated, at least those which come under the head of gastro intestinal catarrh and "cholera infantum" ought to, as these form the vast majority of cases of "epidemic diarrhoea" Exactly the same precaution should be taken as in a disease coming under the infectious diseases Act 1889, viz. notification, isolation, free distribution of disinfectants to the houses where a case of the disease occurred, purification of the premises after recovery or removal, examination of the milk supply etc. This reform would be much more easily carried out than that with regard to the source of milk supplied to infants, as the machinery necessary for it is already in existence for other diseases. If it were done I believe the number of cases of "epidemic diarrhoea" would be reduced by 50 per cent at least.

Rest. - In the treatment of diarrhoeal diseases everyone agrees that physiological rest

should be given to the disordered stomach and intestines, by allowing only the most easily digested and simplest food to be taken. In the treatment of enteric fever in addition to physiological rest for the digestive tract, the most rigid physical rest is enforced for the body, the patient not being permitted to move from the recumbent position until convalescent. The same may be said about gastric ulcer, acute gasthitis, dysentery and many other ailments of the alimentary tract amongst adults.

Now in treating cases of infantile diarrhoea, a disease with high temperatures, rapid pulse, severe nervous symptoms etc., denoting a disease causing grave constitutional disturbance, besides the local symptoms of vomiting and diarrhoea, and associated with the latter there may be ulceration of the intestine, with its accompanying dangers, - in treating a disease of this gravity and importance, would it not only be consistent to <u>insist on absolute bodily rest?</u> Who would ever think about treating a man with typhoid fever or an ulcerated stomach as an out patient? And yet infants with an equally <u>serious disease</u>, and <u>may be with as grave internal lesions</u>, are daily carried to dispensaries and consulting rooms

and what is more are ordered to be brought again; they are jogged up and down by their mothers, they are carried next door to be taken care of temporarily by the neighbours, they are moved and bundled about into a hundred different positions every day. This surely cannot but be injurous. To avoid this evil I have insisted upon all infants with serious diarrhoeal disease being put to bed and not moved from bed for any purpose whatever. The motions can be received and removed in suitable cloths without disturbing the infant. To facilitate this I use large sand bags, which placed on top of the bedclothes on either side of the child assist materially in keeping it quiet. In some very restless infants I have in addition bandaged the arms to the sides and I believe I have saved many lives by this practice.

Directions as to the feeding of an infant with Diarrhoea - As the kind of food given to an infant suffering from a diarrhoeal disease is in most cases the most important part of the treatment, it is absolutely essential that the physician's directions should be carried out to the letter. Now, I find that if these directions are given verbally to the

infant's mother half of your directions are forgotten and the other half often done wrong. The only possible way, I find, is to have printed or typewritten slips of paper with plainly worded but at the same time detailed directions as to the method of preparing the food, and the exact quantity of ingredients desired. Even with this plan careless people too often make mistakes, but it is a great improvement on the oral directions. I refer to the various foods I have found useful, later. Any directions for feeding out of the ordinary run I, of course, write down.

(A). Treatment of simple diarrhoea, of non-Bacterial origin.

Diet. For first few hours give no food at all, after that period weak broth or barley water: in children over two years of age barley water and boiled milk in equal proportions can be used. Complete rest must be enforced.

Drugs. At the commencement of the attack give 2 teaspoonfuls of castor oil to a child 12 months old. After this has been effective - but not before - in thoroughly evacuating the intestine, give 5 - 10 M of Ti Camp Co every 3 hours. There is no necessity

for any more complicated prescription than this - and it is my custom to give the Paregoric in the dose mentioned above with a few drops of spirits of chloroform as a flavouring agent. I have never known this simple treatment to fail.

(B) Treatment of Diarrhoea of Bacterial origin (a) gastro-intestinal catarrh (b) cholera infantum.

(a) Gastro-Intestinal Catarrh -

Diet. In nursing infants the breast should not be given for the first few hours, during this time the thirst can be allayed by a few teaspoonfuls of iced water: When the breast is resumed it should not be given oftener than 3 hours, and in about half the usual quantity. In some cases it will be found necessary to stop the breast feeding entirely, at any rate for a week or so.

In hand fed infants - all milk food must be entirely withheld until the child is thoroughly convalescent. The following foods I have found useful to give, though no doubt there are many others which would be equally efficient. The directions for preparing the food I have in typewritten slips which I give to the mother of the child.

Barley Water - Put a teaspoonful of the best pearl barley in an enamelled saucepan, add a pint of water and boil for a little - this is to cleanse the barley. Pour the water off and replace by a pint and a half of clean water: allow to simmer, not to boil, for an hour, then strain: Add to the liquid when strained 2 teaspoonfuls of the white of a raw fresh egg.

Veal Broth - Take one pound of veal free from bone or fat, add a pint and half of cold water, and a pinch of salt. Place it covered in an oven not too hot, for 4 hours. Strain it, remove the fat and add a pinch of salt.

Egg Water - The white of one fresh egg: one pint of water that has been boiled: 1 teaspoonful of brandy.

Beef Tea. - 1 lb. of finely chopped lean beef. 1 pint of cold water: let it stand for 6 hours in a cool place, on ice if possible. Then allow to simmer, never to boil, for 3 hours, over a small fire: skim off the fat: season with salt.

Raw Meat Juice - Mince 1 pound of best beef steak freed from fat. Cover it with cold water, add a little sugar and let it stand for four hours. Strain

it and add 4 teaspoonfuls of brandy.

In older children Carrick's liquid peptinoids are often very useful: Children under two years of age cannot as a rule be persuaded to take them.

When the infant becomes convalescent a return to milk food can be made but only very gradually. It is better at first to have the milk peptonized by means of "Fairchild's peptonizing milk powders" for 10 - 15 M. In using these powders a common mistake is to use the water bath, in which the vessel containing the powder and the milk is placed, too hot, or keeping it in the water too long.

I think it a mistake to order more than one kind of food to be given, and whatever food is tried it should be given a fair trial before changing it. Do not feed too often: do not give too much at a time.

Rest. The child must be put in its cot and kept there until convalescent. On no account must it be taken out to the doctor's surgery. The coolest and best ventilated room in the house must be used.

Drugs. It must be borne in mind that we are dealing here, firstly, with masses of fermenting food,

undergoing putrefaction in the stomach and intestine: secondly, with swarms of Bacteria of a virulent nature which besides acting on the food, are also producing toxins which being absorbed produce severe constitutional disturbance. The indications of treatment then are to evacuate the decomposing food: to prevent the occurrence of decomposition of further feeding: to combat the action of the toxins: and to restore to health any organs which have suffered.

To thoroughly evacuate the fermenting food from the intestine - give a full dose of two teaspoonfuls of castor oil or 1 - 2 grs. of calomel, which also favourably affects the vomiting. In a few very severe cases I have practised in addition irrigation of the colon. A large sized catheter can be used, and passed 6 - 8 in. so as to reach if possible the sigmoid flexure or beyond. The catheter is attached to a long rubber tube, the other end of which is in a large jug of warm normal saline solution. Back flow can be prevented to a large extent by bandaging the catheter where it enters the anus.

At least 2 or 3 pints of solution must be used - as the object is to distend the colon so as

to reach the coecum. The method is certainly useful, but what general practitioner can spend the time to irrigate the intestines of say 50 children a day: moreover in general practice the parents strongly object to it and it is often difficult or impossible to get their consent.

As regards the vomiting. - The fermenting masses of food from the stomach are soon ejected. To stay the incessant vomiting which as a rule continues after all food has been ejected, I find nothing better than Glycerin Ac Carbolici of the B. P. It is given in one drop doses every hour till the vomiting is better.

Opium - After the alimentary tract has been thoroughly emptied by vomiting and purging the use of opium is often beneficial. In giving opium its action must be borne in mind. It acts as a stimulant to the inhibitory nerves of the intestine and thus checks peristalsis (Nothangel): it diminishes pain: it checks the secretions of the intestine.

It is to be given then after the alimentary tract is thoroughly emptied in order to allay the excessive peristalsis. It is not to be given if the motions are offensive in smell, or if there

are cerebral symptoms, or a high temperature.

It is indicated early in the disease: also sometimes in subacute cases which have lingered on for some time, and in which the giving of food is almost immediately followed by a motion, because the food is hurried along the bowel by the excessive peristalsis, and there is no time for digestion. The opium must be stopped as soon as the desired effect is obtained; and it is best given alone in form of Ti Camph Co 10 M doses for a child 12 months old: or Ti Opii ½ minim doses. Other medication can be continued at the same time as the opium is given; but it is better in a separate prescription.

Stimulants. As often the severity of the disease prevents any food being taken, or at any rate digested, for 1 - 2 days; and as all the time the vomiting and diarrhoea are going on, stimulants must be begun at once. It is a frequent mistake to overlook the giving of stimulants until the condition of the child is almost hopeless, and it thus becomes a dernier resort, whereas if given early and in sufficient quantities, - 2 teaspoonfuls every 4 hours for a child 12 months old, of best whisky or brandy - I am certain it is one of the most essential

factors in bringing the case to a successful issue.

Drugs having an Antiseptic Action on the Alimentary tract. As regards the stomach the best and simplest drug of this description is in my opinion Carbolic Acid, and given in the way I have indicated it also allays the vomiting. With regard to the intestine however, according to Escherich and others, very few Bacteria are found in the small intestine: because the rapid peristalsis, and great secretion sweeps the contents of the upper intestine, the Bacteria included, into the lower parts of the alimentary tract. Consequently any antiseptic drug, must be insoluble until the large intestine is reached. Of these drugs I have found Salicylate of Bismuth 1 4 grs. every 3 hours, the most useful.

If the symptoms point to decomposition in the small intestine - salol, which is broken up into carbolic and salicylic acids, is the most useful in 2 - 5 grs. doses for a child 12 months old.

Convalescence - When the acute symptoms have passed off the combination of Dilute Hydrochler acid (in $\frac{1}{2}$ - 5 M. doses) with Pepsin, will do much to restore the normal digestive functions. If milk is being

given acids must not be used unless the milk is wholly peptonized.

Temperature - If the temperature is 103° or above, means must be taken to reduce it, and the best method is to put the child in a luke-warm bath, and gradually reduce the temperature by pouring in cold water.

Convulsions - Should also be treated by means of the bath, and also if necessary by administration of Pot Bromide, in 5 grs. doses every hour till sleep obtained for a child 12 months old: smaller doses are useless and inefficient.

To summarise then the treatment of acute gastro-intestinal catarrh is as follows:-

I. Evacuate the alimentary tract by castor oil or calomel, and if necessary irrigation of the lower bowel.

II. Carefully regulate the diet.

III. Give absolute rest in bed.

IV. When the stomach and intestine have been evacuated give Carbolic Acid to allay the vomiting, and opium to diminish peristalsis and diarrhoea.

V. Give stimulants in the form of brandy or whisky from the first commencement of the attack.

VI. If necessary give intestinal antiseptics, of

which the best is salicylate of Bismuth.

VII. Treat any complication that arises appropriately: convulsions and high temperature by means of baths and if necessary the former also by large doses of Bromide of potassium.

(B) Treatment of Cholera Infantum - These cases must be looked upon as cases of acute-poisoning. The whole course of the disease (vide symptoms) indicates a sudden invasion by the most virulent micro-organisms and rapid absorption of the toxins produced by them. Our efforts then must be directed to supporting the vital functions of the body until there has been time to eliminate the poison from the system.

Feeding - It is useless to attempt to give anything by the mouth except brandy, whiskey, or champagne: of these champagne is the best, as it is absorbed more quickly and therefore is less likely to be rejected: it should be given in minute quantities every few minutes. After the vomiting and the purging, and the general symptoms are better, some of the foods mentioned under "acute gastro-intestinal catarrh" such as egg water or beef tea, may be commenced, giving at first only small quantities and

gradually increasing it.

Drugs. There is no necessity here to give any cathartic or emetic to empty the alimentary tract as nature does this most efficiently and thoroughly. The indications are to allay the vomiting and diarrhoea, to stimulate the heart, and to soothe the nervous system.

Opium fulfils all these conditions, but it is useless to attempt to give either this or any other drug by the mouth. It may be given in two ways: either hypodermically or as an enema.

Hypodermically $\frac{1}{100}$ gr. can be given to a child 1 year old, and repeated in 2 or 3 hours. By the rectum 5 M of Ti Opii given in a little warm starch solution and repeated in 3 hours.

I have seen wonderful improvement to quickly follow this treatment, especially as regards the heart's action which often markedly improves after the first injection.

Opium is of course contra-indicated where there are convulsions, delirium or coma with a feeble pulse: In these cases hot baths with mustards and free stimulation is the only chance. When convalescence is established treat as in acute gastro

intestinal catarrh by giving Hydrochloric acid and pepsin and careful dieting.

(C) Treatment of Diarrhoeas having an inflammatory origin - Entero-Colitis.

In describing the symptoms of entero-colitis I divided it into 4 varieties (I) dysenteric diarrhoea (II) Secondary form of entero colitis (III) Typhoid form (IV) Subacute cases. Although these forms differ in various particulars in their symptoms: yet they have one important point in common, viz., that in all of them the symptoms are associated with an intestinal lesion of an inflammatory character, producing anatomical changes in the bowel. I think therefore that the treatment stated below is applicable to all four varieties.

Rest. This is most important; absolute rest in bed must be insisted upon for some weeks. The movements of the child being restrained if necessary by sandbags used as I before described. When there are grave lesions of the intestine, perhaps ulceration, the importance of this is obvious.

Diet. There is often great difficulty in selecting a food that will suit the infant. Moreover, as the disease lasts for three or four weeks at the

least, the infant often tires of one food; consequently one food after another must be patiently tried until a food is found that the child will take, and this must be changed as often as the child tires of it. It is better to begin with one of the meat broths, prepared as mentioned, in acute gastro-intestinal catarrh - raw meat juice often acts satisfactorily in these cases. When the morning and evening temperature have been normal for a week, milk may be returned to gradually, being at first fully peptonized with Fairchild's Peptonizing milk powders.

Stimulants. When there is feeble pulse, cold extremities, prostration and nervous symptoms of apathy and stupor, these should be given freely. Give the best whiskey or brandy, one teaspoonful every 4 hours for a child 12 months old.

Drugs. We must remember that the seat of the disease is in the lower portion of the ileum, the colon or the rectum, consequently any drug that is given must not disturb the digestive and absorptive powers of the stomach and upper portions of the intestine. If a drug given is thought to be disturbing the digestion it is better to cease all medication directed at the seat of the disease, and to assist the feeble digestion

by mineral acids and pepsin, and thus to influence the changes in the lower bowel indirectly.

Bismuth Subnitrate - is the only drug given by the mouth which I have found of much value in this disease. It must be given in large doses 30 grs. 3 times a day for an infant 12 months old. In the usual doses used for infants viz. 2 - 5 grs. it is quite useless. It is best given in a powder, alone, or with a little sugar. It acts as an antiseptic in the ileum and colon: it acts as an astringent: it mechanically coats the inflamed surfaces of the intestine and acts as a protective covering for them whilst they are undergoing changes of repair.

If there is much tenesmus or pain an enema of starch solution with 2 or 3 M of Ti Opii is very useful.

In the dysenteric form of the disease, where the lesion is mainly in the rectum, and lower part of the colon, irrigation with a solution of Nitrate of Silver about 2 grs. to the ounce, and used every second day is often beneficial. This irrigation can be carried out by the nurse and often is of great value.

In the typhoid form it would be interesting to note the effect of Typhoid plasma as recommended

by Dr Macfadyn of the Jenner Institute in the Brit. Med. Journal (March 21st and 28th 1903.) The most important point in the treatment of entero-colitis is to insist on complete rest in bed until the lesions in the intestine have had time to become at any rate partially repaired.

(D) Chronic Diarrhoea.

This is the only form of Diarrhoea (which is here described) in which rest in bed is not advisable. Rest, certainly, the infant must have, but it must be combined with fresh air. The child must be taken out daily in its carriage unless the weather is very severe. Removal to sea or country air will often do more to affect a cure than any other remedy. The infant's carriage must be of the kind which will allow it to recline in a recumbent position.

Diet - Practically the same as in entero-colitis: giving at first meat preparations, especially raw meat juice: and gradually introducing milk as convalescence sets in. Mellin's Food made with veal broth instead of milk is often useful when there is much flatulence and fermentation of the stomach.

Drugs - These must be mainly directed against symptoms. Chalk mixture and aromatics, if

there is much fermentation and flatulence. Starch and laudanum enemata if there is tenesmus and pain with dysenteric type of motion containing mucus and blood. Occasional astringent enemata of 1 3 grs. of Nitrate of silver to the ounce.

Angiers Petroleum Emulsion - In Chronic Diarrhoea

I have found this of great value given in doses of 20 min. four times a day for a child 12 months old. Besides improving the general nutrition of the body, it seems to have a distinct action in improving the contents of the colon and rectum, and there is often a marked improvement in the appearance and odour of the stools after it has been used for a few days. To test its efficacy I have in several cases of chronic diarrhoea given it alone without any other form of treatment except regulation of the diet and although I kept no exact record of the Cases, as far as I remember every case which persevered sufficiently long with the medicine, showed marked improvement.

Note - This paper is not, and does not presume to be, a complete resumé of all the works and papers on

the diseases dealt with. The following books and papers have been used for reference:-

Ashly & Wrights Diseases of Children.

Ballard Brit. Med. Journal 1883 II 363

Nothangel Beiträge zur Physiologie und Pathologie des Darnes Berlin J. 1885.

Emmett Holt in Keating's Cyclopaedia of Diseases of Children.

Hope. E.W. Etiology of Infant Diarrhoea Liverpool Med. Chir Journal 1885.

Goodhart & Still Diseases of Children.

Escherich Jahrbuch fur Kinderheilk Bil XXVII S126.

In most instances the authors referred to are mentioned in their proper place in the paper.